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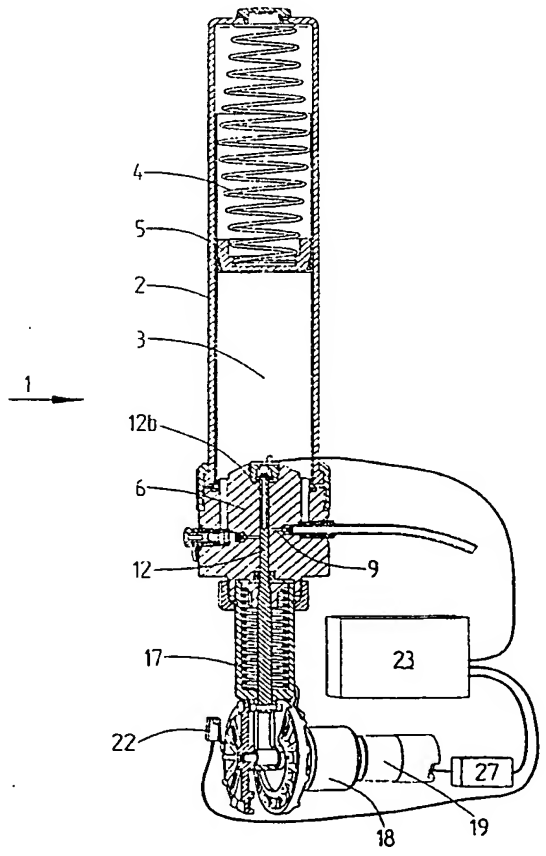
(54) Title: ARRANGEMENT IN A LUBRICANT PUMP



(57) Abstract: Arrangement in a lubricant pump (1) comprising a housing (6) equipped with outlets (9) and lubricant chamber (2). An electrical arrangement (19) is adapted to drive an axially displaceable piston (12) in an axial cylindrical bore in the housing (6). The piston has through-openings (12c) arranged radially and adapted, in a predetermined piston position and together with the outlets (9), to open a passage for lubricant from an outlet (12b) located in the piston to a predetermined outlet (9). The passages are arranged essentially in succession to one another and adapted to allow lubricant to be pumped out. The arrangement also comprises a position sensor (22) adapted to read off the position of the piston in the event of a piston stoppage.

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Arrangement in a lubricant pump

The present invention relates to an arrangement in a lubricant pump according to the pre-characterising clause of the independent claim 1.

Connecting a lubricant pump to a plurality of lubrication points by way of ducts or pipes so that lubricant, for example grease or oil, can be pumped out to a plurality of different lubrication points from the same pump, is already known

Obstructions can occur in the ducts and pipes so that the lubricant cannot be pumped out. Such obstructions take the form, for example, of a blocked nozzle, dirt in the hose or quite simply a crushed pipe. Such obstructions result in poor operating conditions for the pump, but above all for the appliance or device to which the pipe with the obstruction leads, since the appliance receives a poor supply or no supply of lubricant. Poor lubrication is often discovered late and when it is discovered damage has often already occurred, involving expensive repairs and costly down time. In cases of poor lubrication where there are many pipes connected it is difficult to identify which of the lubrication points is receiving the poor lubrication. This results in additional locating work that is difficult and time-consuming.

It is an object of the present invention to produce an arrangement that eliminates or at least reduces the problems described above. This is achieved by an arrangement according to the characteristic in claim 1.

Preferred embodiments have, in addition, any or some of the characteristics specified in the subordinate claims.

The invention will be explained in more detail with the aid of the drawing attached, which illustrates examples of embodiments of the arrangement according to the present invention.

Figure 1 in a partially cut-away diagram shows an example of a lubricant pump

Figure 2 shows an example of a piston.

Figure 3 shows an example of an eccentric wheel

Figure 4 shows the extent of an outer casing covering 360 degrees of a cylinder bore

Figure 5 shows an example of a housing with a cylinder bore and outlet

Figure 6 shows a partial enlargement of a cut-away view of the lubricant pump in fig. 1.

Figure 7 in a cut-away view shows a plug in an outlet.

In figure 1, 1 generally denotes a lubricant pump with a chamber 2 for a lubricant 3. The chamber 2 is adapted to receive standard capsules containing lubricant. A compression spring 4 is located at the first end of the chamber 2, adapted to exert pressure on the lubricant by way of a plunger 5, thereby pressurising the lubricant 3 in the chamber 2. A pump housing 6 is connected to the second end of the chamber 2 and incorporates an inlet 7 with a non-return valve 8, a plurality of outlets 9 each with a non-return valve 10, an axial cylindrical bore 11 and a piston 12. The inlet 7 is located between the lubricant chamber 2 and the piston 12. The outlets 9 lead from the cylindrical bore 11 and leads radially out of the pump housing 6. The non-return valve 8 is arranged connected to the inlet 7 and is adapted to allow lubricant 3 to be delivered from the chamber 2 to the bore 11, but not in the opposite direction. The non-return valves 10 are similarly arranged at each outlet 9, but in contrast to the non-return valve 8 at the inlet 7, the non-return valves at the outlets only allow lubricant to be delivered from the bore 11. The piston 12 is adapted to perform a reciprocating movement in the bore 11, a piston movement away from the inlet 7 causing the bore 11 to fill up with lubricant 3. A piston movement in the opposite direction, that is towards the inlet 7, in conjunction with the non-return valves 10 and 8, causes lubricant 3 to be pumped out of the bore 11 to the outlet 9. At least one lubricant pipe 13 is connected to the pump housing 6 at any of the outlets 9, so that lubricant 3 can be delivered from the bore 11 by way of the outlet 9 and the lubricant pipe 13 to a lubrication point (not shown).

The piston 12, which is shown enlarged in figure 2, comprises a distal surface 12a, an outlet 12 b, a radial through-opening 12c and a slot 12d located at the opening 12c. The outlet 12b is preferably located centrally in the piston 12 and extends from the distal surface 12a to the opening 12c. The opening 12c thereby connects the outlet 12b to the slot 12d, which surrounds the piston 12. When the piston 12 moves towards the inlet 7, lubricant 3 is thus forced out in a radial direction by way of the outlet and the opening 12c together with the slot

12d. At predetermined piston positions therefore passage is allowed from the outlet 12b via the openings 12c to a predetermined outlet 9. The predetermined positions are arranged essentially in succession to one another in the direction of movement of the piston 12, so that essentially one passage at a time is open.

When the lubricant 3 cannot leave any outlet 9 due, for example, to some obstruction in the pipe 13 or the outlet 9, the piston 12 ceases its movement towards the inlet 7 due to the fact that the pressure in the lubricant is increased in excess of the normal. The position in which the piston 12 stops is determined by the location of the slot 12d on the piston in relation to the position of the outlet in question. Operatively connected to the piston is a position sensor 22, adapted to read off the position of the piston 12 and to communicate this to a monitoring unit 23, which is in turn adapted to give warning that a lubrication point is not receiving lubricant.

In the preferred embodiments, the axial distance between two successive outlets 9 is somewhat less than the axial extent of the slot 12d. The slot 12d is therefore connected to two successive outlets, for example 9a and 9b, for a short section of the piston travel. This is so that the piston 12 will not stop between two outlets 9. The distance between a first and a third outlet, for example 9a and 9c is, on the other hand, so large that the piston 12 stops when an obstruction occurs. The outlets 9 are furthermore located on parallel helices and are exemplified in figure 5 by two essentially opposing groups of four outlets per group. In a piston movement lubricant is fed out into the outlets 9, from 9a to 9d in turn. This location of the outlets 9 gives a compact housing 6 and facilitates installation of the pump 1.

The quantity of lubricant 3 that is pumped through a particular outlet, for example 9b, by a piston movement is, for a given outlet diameter, proportional to the distance from the preceding outlet 9a. In order to ensure that the first outlet 9a also always receives the same quantity of lubricant 3, a blind outlet 24 is arranged ahead of the outlet 9a and is adapted to return lubricant 3 to the chamber 2. Thus minor variations in the plunder movement do not result in the first outlet 9a receiving different quantities of lubricant. The blind outlet 24 also means that too long a piston movement does not produce a piston stoppage.

At the outlets 9 there is an inner seal 25 and an outer seal 26. The inner seal 25 is adapted to seal the pipe 13 in a first instance when the outlet is delivering lubricant to a lubrication point. The outer seal 26 is adapted to seal a plug 14 in other instances when the outlet is not delivering lubricant to a lubrication point. A return duct 15 opens out between these two seals 25, 26 and connects each outlet 9 to the chamber 2. When the piston 12 moves towards the inlet 7 and the slot 12d reaches a plugged outlet 9 therefore, no significant increase in pressure occurs in the lubricant 3 in the outlet 12b and the movement of the piston 12 continues past the plugged outlet 9.

The pump is preferably driven by an electric motor 19, adapted to move the piston 12 away from the outlet 7 by means of a transmission 18 and eccentric wheel 21. The eccentric wheel 21 has two helical tracks 21a, one of which is shown in figure 3. The helical tracks 21a of the eccentric wheel are arranged opposite to and parallel with one another. A pin 20, connected to the piston 12 at right angles, is adapted to run in the helical tracks 21a in the direction of rotation 21c of the eccentric wheel when the latter rotates. At the terminal point 21b of the helical tracks 21a contact between the pin 20 and the helical tracks 21 ceases, a coil spring 17 returning the piston 12 and the pin 20 in a slot in the eccentric wheel 21 in the axial direction of the bore 11 towards the inlet 7.

The monitoring unit 23 is coupled to the pump 1 and is connected to the position sensor 22, a load sensor 27 and a contact 28. The position sensor 22 is arranged in working contact with the piston 12. In the preferred embodiment the sensor 22 is located at the eccentric wheel 21, since there is more space there and fewer problems with impurities. Thus the piston position is determined by way of the eccentric wheel 21 only when it is in working contact with the piston 12, in other words when the pin 20 bears against the helical tracks 21a. The load sensor 27 measures the load on the motor 19 and decides whether the pin 20 is in contact with the helical grooves 21. Should an obstruction occur in the pipe 13, the spring 17 does not return the piston 12 to its normal starting position, but stops somewhere in its travel. This means that when the eccentric wheel 21 rotates the pin 20 encounters the helical grooves 21a closer to the terminal point 21b of the helical tracks than usual. In this position the motor load increases and the load sensor 27 transmits a signal to the monitoring unit 23, which is adapted to calculate from the signals of the sensor 22 and the sensor 27 where the piston is situated

and thereby to determine which outlet 9 is not functioning. The contact 28 is adapted to be depressed by the plunger 5 when the lubricant 3 in the chamber 2 is depleted.

It will be obvious that the invention can be modified in many ways within the framework of the invention. Thus in an alternative embodiment the position sensor 22 is arranged directly on the piston 12. In a further embodiment the piston 12 is connected to the drive 19 by way of a connecting rod and a crank throw, which also mean that the return spring 17 is replaced.

Claims

1. Arrangement in a lubricant pump (1) comprising a housing (6) equipped with outlets (9) and lubricant chamber (2), a piston (12) axially displaceable in an axial cylinder bore in the housing (6) by means of an electrical drive arrangement (19), the piston at a first end having an axial outlet (12b) which is connected to a through-opening (12c), arranged essentially radially on the piston and adapted, in a predetermined piston position and together with the outlets (9), to open a passage for lubricant from the outlet (12b) to a predetermined outlet (9), the second end of the outlet (12b) being connected to the lubricant chamber (2) by way of an inlet (7) and a non-return valve (8) adapted together with the inlet (7) to allow the bore (11) to be filled with lubricant, **characterised in that** the passages are arranged essentially in succession to one another and that a position sensor (22) is adapted to read off the position of the piston in the event of piston stoppage.

2. Arrangement according to claim 1, **characterised in that** in each outlet (9) that is not being used for lubrication there is a plug (14) allowing return of lubricant (3) to the lubricant chamber (2)

3. Arrangement according to either claim 1 or 2, **characterised by** a load sensor (27), adapted to measure the electrical load on the drive arrangement (19) and a monitoring unit (23), adapted to monitor the load on the basis of the position of the piston.

4. Arrangement according to any of the preceding claims, **characterised by** an eccentric wheel (21), operatively connected to the drive arrangement (19) and adapted, under rotation, to displace the piston (12) axially away from the inlet (7) in order to allow the bore (11) to be filled with lubricant (2).

5. Arrangement according to any of the preceding claims, **characterised in that** the eccentric wheel (21) has a slot in the axial direction of the bore for releasing the piston (12), which has a spring, adapted to return the piston (12) in the direction of the inlet (7).

6. Arrangement according to any of the preceding claims, **characterised in that** the position sensor (22) is adapted to read off the position of the piston from the position of the eccentric wheel (21).

7. Arrangement according to any of the preceding claims, **characterised in that** the electrical drive arrangement (19) is formed by an electric motor.

8. Arrangement according to any of the preceding claims, **characterised in that** the outlet (9) opens out into the cylinder bore (11) essentially along the parallel helical lines.

9. Arrangement according to any of the preceding claims, **characterised in that** a blind outlet (24) is arranged ahead of the outlet (9) in the direction of travel of the piston (12) towards the inlet (7).

10. Arrangement according to any of the preceding claims, **characterised in that** there is a slot (12d) in the outer surface of the piston situated transversely to the direction of travel of the piston and connected to the radial openings (12c).

Fig.1

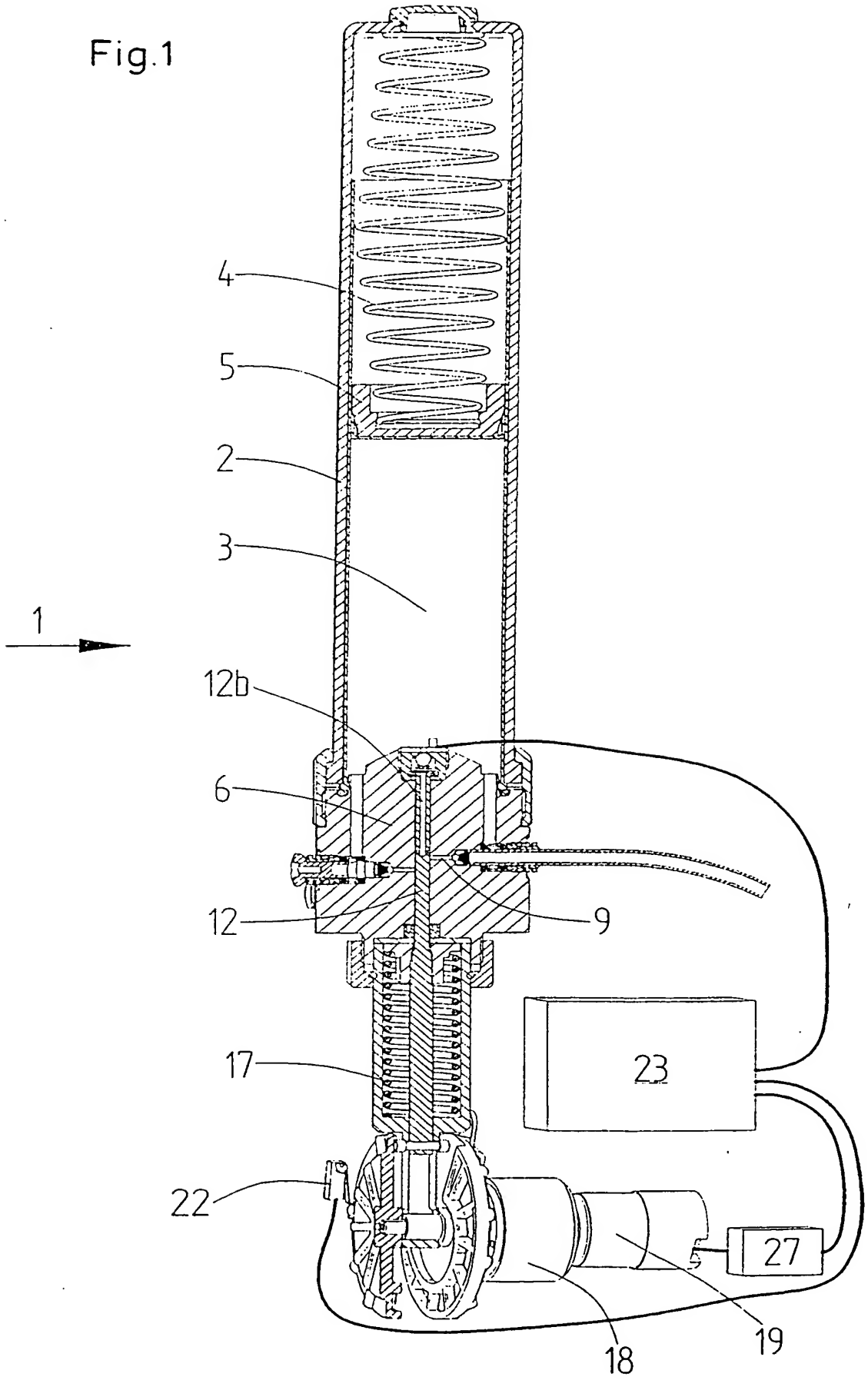


Fig.3

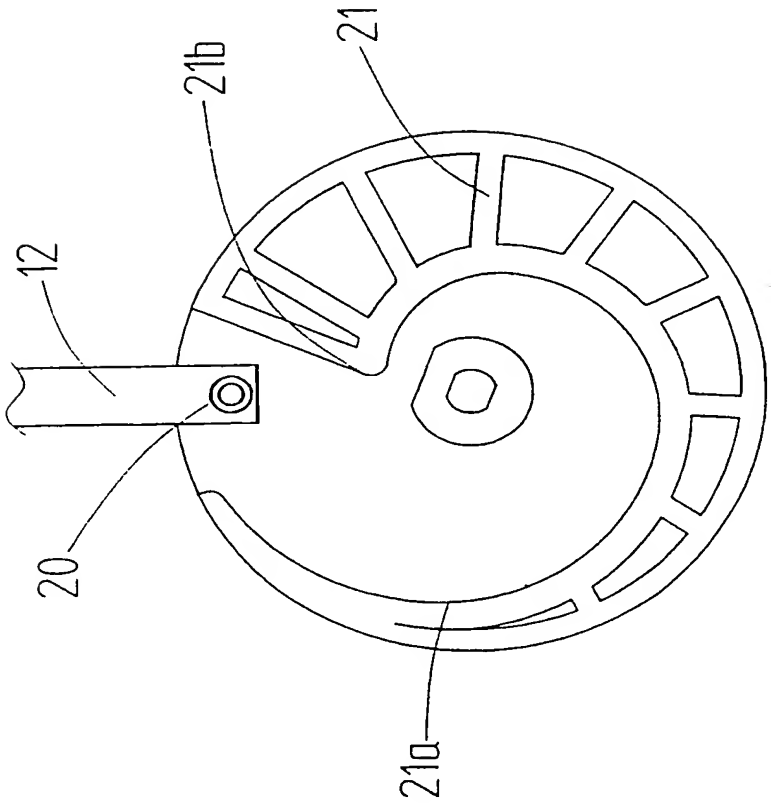


Fig.2

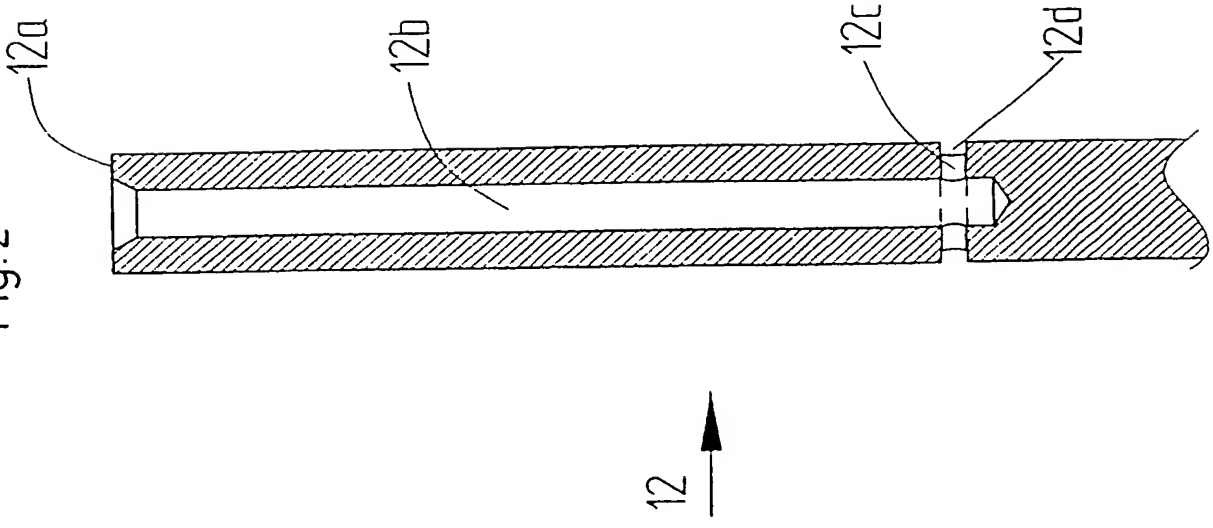


Fig. 4

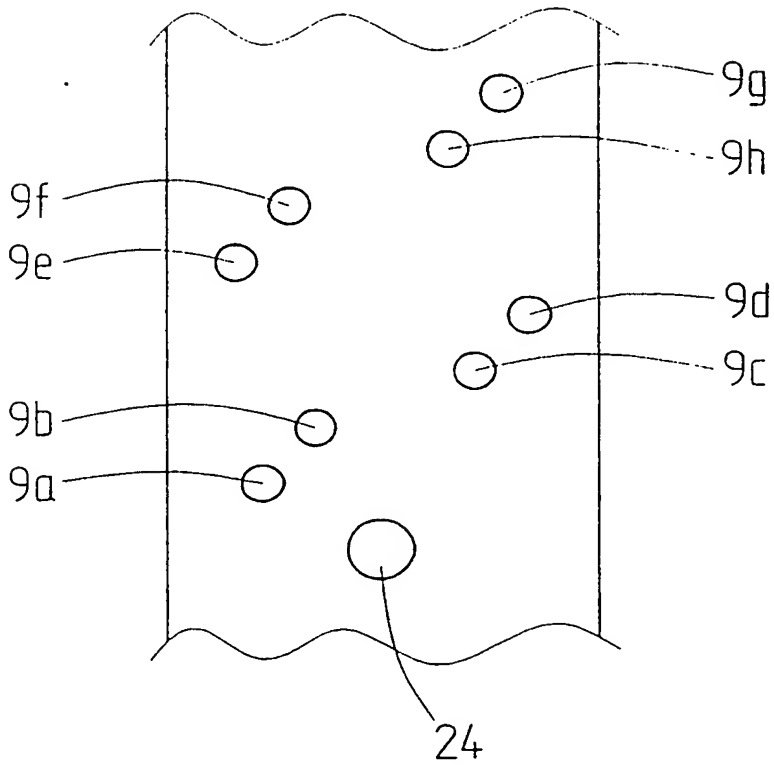


Fig. 5

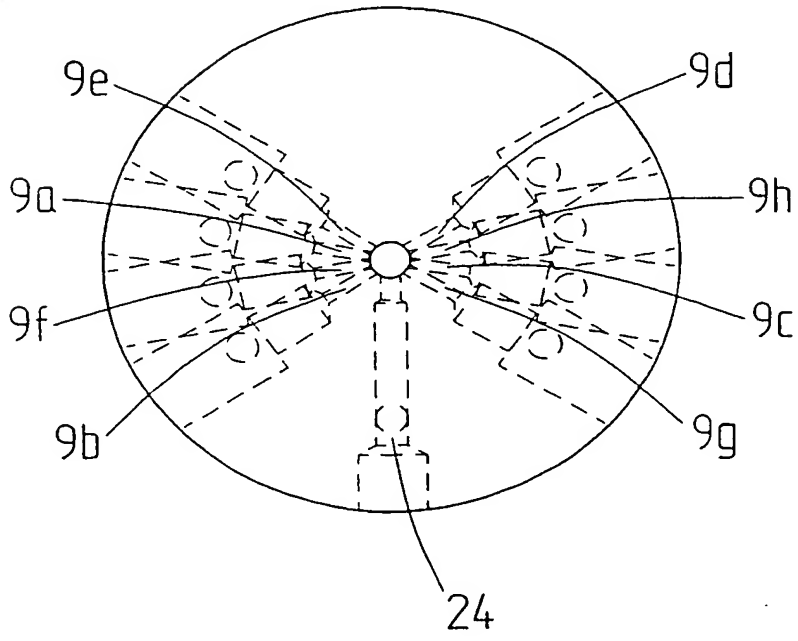


Fig. 6

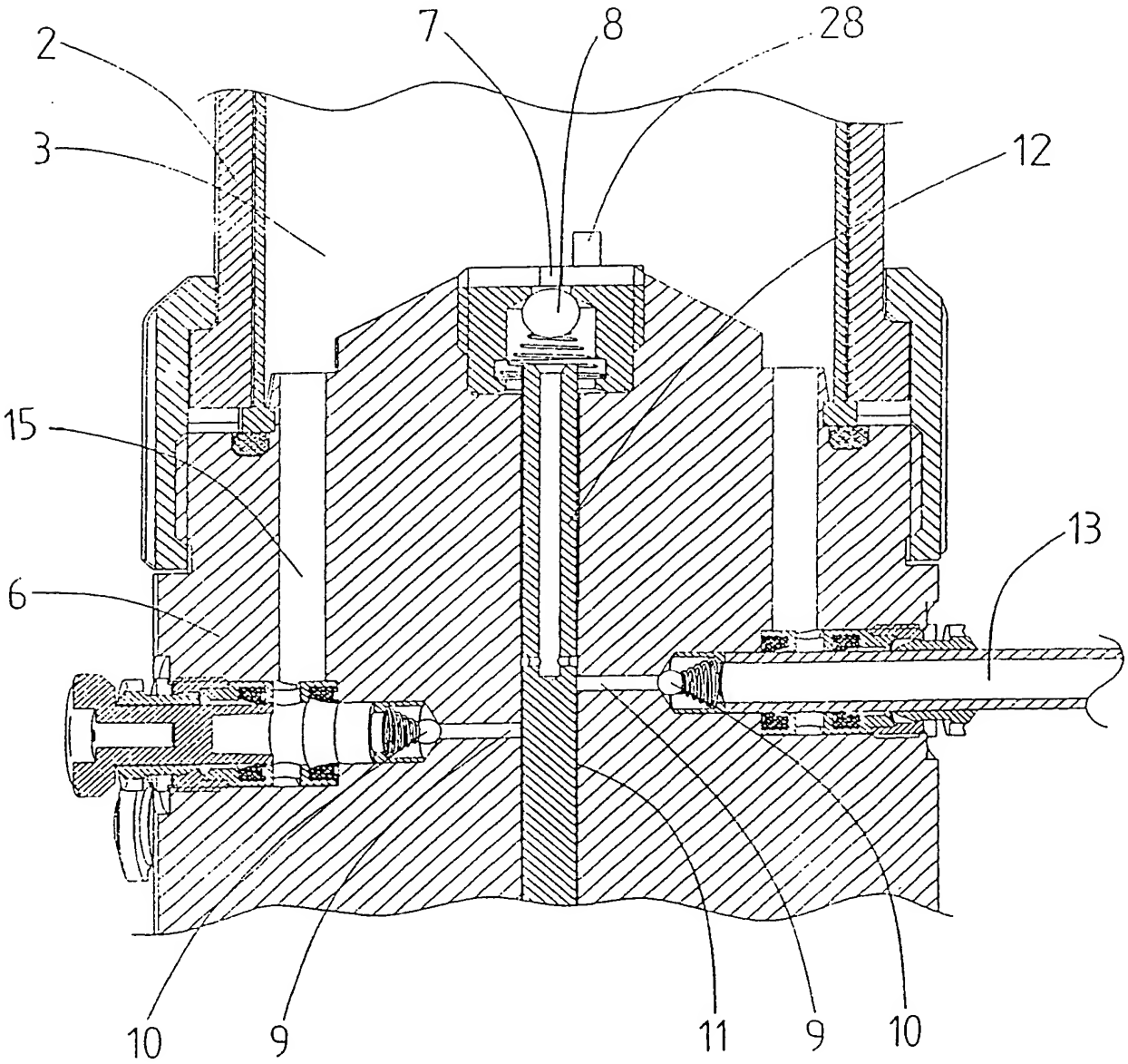
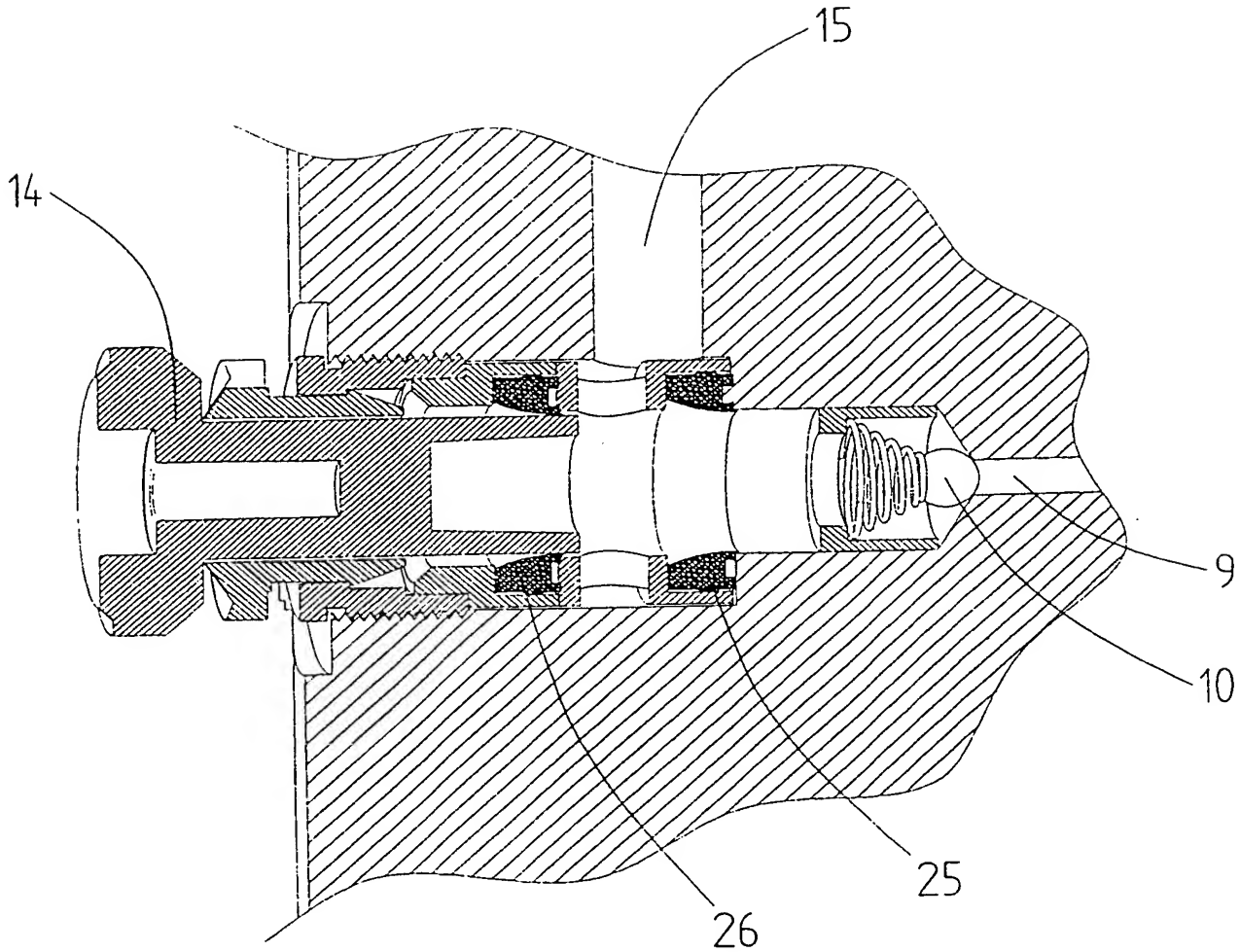


Fig. 7



INTERNATIONAL SEARCH REPORT

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PCT/NL 00/00790

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16N13/02 F16N13/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16N F04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 286 691 A (STONG JACK V) 1 September 1981 (1981-09-01) column 4, line 23 -column 14, line 41; figures	1
A	GB 1 310 946 A (SAITO S) 21 March 1973 (1973-03-21) column 3, line 56 -column 7, line 116; figures	1
A	GB 943 903 A (MEYER) 11 December 1963 (1963-12-11) the whole document	1
A	US 2 908 898 A (MUELLER) 13 October 1959 (1959-10-13) figures	1

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☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4286691 A	01-09-1981	NONE	
GB 1310946 A	21-03-1973	NONE	
GB 943903 A		NONE	
US 2908898 A	13-10-1959	NONE	